M. I. R. L. Report No. 26

ANNUAL REPORT
of
RESEARCH PROGRESS

MINERAL INDUSTRY RESEARCH LABORATORY
COLLEGE OF EARTH SCIENCES AND MINERAL INDUSTRY
UNIVERSITY OF ALASKA
COLLEGE, ALASKA 99701

1970

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MINERAL INDUSTRY RESEARCH LABORATORY CESMI

ANNUAL REPORT OF RESEARCH PROGRESS 1970

MIRL STAFF

UNIVERSITY OF ALASKA
COLLEGE, ALASKA 99701

SEPTEMBER 1970

MINERAL INDUSTRY RESEARCH LABORATORY STAFF

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Herbert H. Rasche, Head, Department of Geography and Professor of Geography

Frederick C. J. Lu, Assistant Professor of Mineral Economics

Donald Grybeck, Assistant Professor of Geology

Bruce I. Thomas, Mining Engineer, representing the Bureau of Mines, U. S. Department of the Interior

CONSULTANTS

Marvin J. Andresen, Consulting Geologist, Geonomics

Charles F. Herbert, Consulting Engineer

* Full time members

CONTENTS

ABOUT THE COVER

In 1969, approximately 10 million dollars was spent on exploration for hardrock minerals in Alaska. In 1970 the figure will probably be closer to 15 million dollars. This year, in order to dramatize the feeling of excitement and hope that is accompanying this tremendous exploration effort, we have used an aerial photograph of the new Twin Buttes mine for a cover illustration for the Annual Report, and have indulged in a little wishful looking into the future.

The Anaconda Company acquired the property, 25 miles south of Tucson, in 1963, and conducted exploration for two years. It was buried under 400 to 600 feet of alluvial overburden. To bring the mine to its present state of full production, a record was set for pre-production stripping: more than 266 million tons. It is now producing 30,000 tons of ore per day, with an average grade of 0.5 to 0.7 percent copper plus some molybdenum. This will yield 5000 tons of copper per month. The mine may reach dimensions of one x one and a half miles. In the pit alone, 160 men are employed.

Photo by Tim Hurley, furnished by the courtesy of the Anaconda Company, Office of Twin Buttes Operations, R. D. Lynn, Manager and J. B. Knaebel, Vice President.

ORGANIZATION, PURPOSE AND FUNCTIONS

The Mineral Industry Research Laboratory was created by the Alaska Legislature in 1963 for the purpose of conducting basic and applied research aimed at helping to foster the mineral industries in Alaska. It is part of the College of Earth Sciences and Mineral Industry. During the past year the Dean of the College acted as the Director, and there were three full time professional members and a secretary. In addition, several consultants and part time workers from other departments in the University have worked on certain projects, and as many as seven or eight students have been employed.

Although the Laboratory has cooperated closely with Federal, State, and University agencies also concerned with the mineral industries and earth sciences, it fills a unique place in that its function is specifically confined to the Alaskan scene.

Even so, the stated purpose allows a broad range of activities open to the Laboratory, from coal and mineral beneficiation studies to instrument development and regional resource surveys.

A study of past mineral production for Alaska indicates that production has been erratic, but that production of non-petroleum minerals is now in a serious decline. Although the discovery and potential production of oil on the North Slope represents a tremendous step toward self-sufficiency for Interior Alaska, many economists believe that only hardrock mining, or the production of coal for export, or both, can provide the economy that will allow a stable employment environment to develop. For these reasons, most of the Laboratory's efforts so far have been connected with hardrock exploration or beneficiation, or coal utilization. As the need for research in mining methods develops, more emphasis will be directed that way.

Because of the uniquely Alaskan character of the work at the Laboratory, it is natural that service to the public should also become one of its important functions. Advice and information are supplied to prospectors and visitors throughout the year, and when services are unavailable elsewhere, analyses are performed.

The basic philosophy of the Laboratory can be summed up by saying that it tries to fulfill its function of fostering the Alaskan mineral industry in any way possible, among others, through research which will benefit the whole industry, by services, open to everyone, by support of theses, or by publishing works already finished.

FACILITIES

The Mineral Industry Research Laboratory has been housed in the Brooks Memorial Building and one room of the library building during this year.

Major advances have been made through the acquisition of coal research equipment. In addition, the Laboratory has acquired accessory attachments to its research microscope which now makes it possible to determine microhardness of small mineral grains, a definite aid in the determination of the mineral composition of a sample. Specific ion equipment has also been purchased that enables the analyses of samples for fluorine content, and provides the basis for research in the application of this technique to exploration geochemistry.

At this time, plans are to install the Laboratory in a suite of offices in the Chapman Building. The Laboratory will, however, continue to utilize the facilities of the College of Earth Sciences and Mineral Industry for many research projects.

COMPLETED RESEARCH

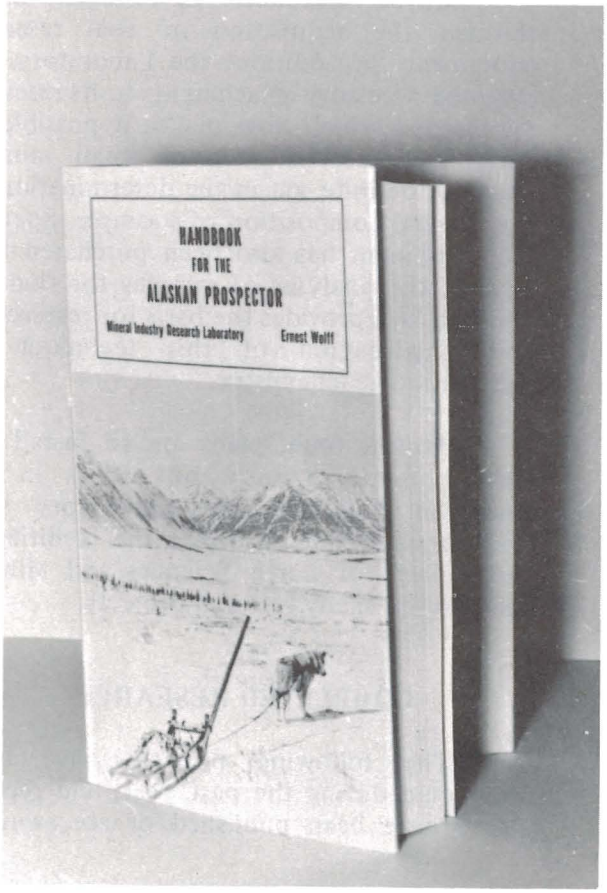
The following projects have been completed during the past year, and reports either have been published or are awaiting

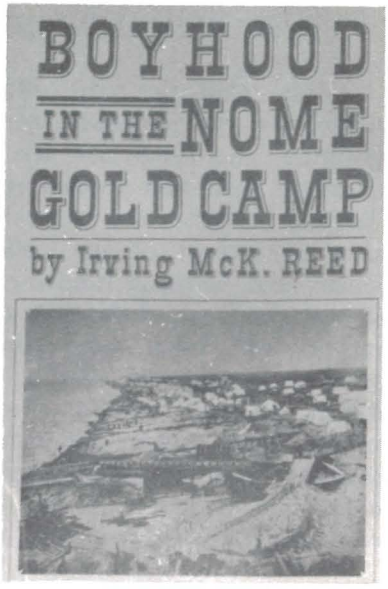
publication.

Reprinting Handbook for the Alaskan Prospector

The writing of this book, chiefly during the 1950's, was sponsored by a program of "mining research." It was printed privately in 1964 with an arrangement whereby the University received a royalty for its part in sponsoring the writing.

The first edition went out of print by 1968, and it was decided that the Mineral Industry Research Laboratory would publish the second edition. Corrections were made to the original text, and an addendum chapter written to bring up to date some of the techniques and ideas described. Six thousand copies were published, which will supply the demand for several years.





Recent Publications

Reprinting the NORTH Report

In 1968 the Laboratory issued a report entitled, "Mineral Resources of Northern Alaska." This report, commissioned by the NORTH Commission, rapidly went out of print. In the summer of 1969, a new section on the petroleum industry was written and the entire report was reprinted. The reprinting was chiefly funded by the NORTH Commission.

Boyhood in the Nome Gold Camp

The Laboratory was instrumental in publishing the manuscript entitled, "Boyhood in the Nome Gold Camp" by the late Irving McK. Reed. This is a 70 page booklet in which he describes Nome near the turn of the century, as viewed through the eyes of an enthusiastic and observant growing boy. Mr. Reed, pioneer, active former Territorial government official and a mining engineer, had a continuing interest in the affairs of the State of Alaska right up to the time of his passing, January 1968. This publication may be obtained from the College of Earth Sciences and Mineral Industry, University of Alaska, College, Alaska for $1.50.

Southeastern Alaska mineral commodity maps.

Mineral Commodity Maps of Southeastern Alaska

During the course of work on a report on the mineral resources of Southeastern Alaska (see below), mineral occurrences in Southeastern Alaska were plotted by computer at a scale of one inch = 20 miles. Maps were prepared showing the locations of deposits of copper, gold, lead, molybdenum, iron, and nickel, and also for all deposits, including non-metallics, and for metallic deposits. Finally the currently active claims were plotted, and a map showing major faults was prepared. All maps were printed on translucent paper so that they could be overlaid on a geological map of the region. Because of interest by exploration and mining companies, it was decided to issue a limited number of these maps in time for the 1970 field season. Three hundred copies were printed as MIRL Report No. 25.

Alaska Mining Law Manual

A revised manual on mining laws in Alaska, by Charles F. Herbert, intended for use by prospectors, miners, and others interested in the search for minerals, has just been published. Mr. Herbert, a graduate mining engineer, has mined, prospected for himself and several companies, is a former Deputy Commissioner of Natural Resources for the State of Alaska and is presently a consulting mining engineer. The manual is available through the College of Earth Sciences and Mineral Industry, University of Alaska, College, Alaska 99701. The cost is $4.00.

Beneficiation of Tin-Tungsten Ore from Lost River, Alaska

P.C.E. Exploration LTD of Toronto, Canada, the sponsors of this project,

submitted two ore samples. These samples were pulverized to 48 mesh and were separated by gravity, high intensity magnetic, and high tension methods of beneficiation. Final concentrates of wolframite, cassiterite and tailing products from the beneficiation processes were analyzed for tin and tungsten by atomic absorption spectrophotometry. The project is completed, and the report has been submitted to the sponsor.

Utilization of Fly Ash

Potential uses of fly ash that is generated in the coal-fired power plants of the area has been investigated by the Laboratory. Locally produced fly ash has been analyzed, and an open file report is available for reproduction at the user's expense.

RESEARCH IN PROGRESS

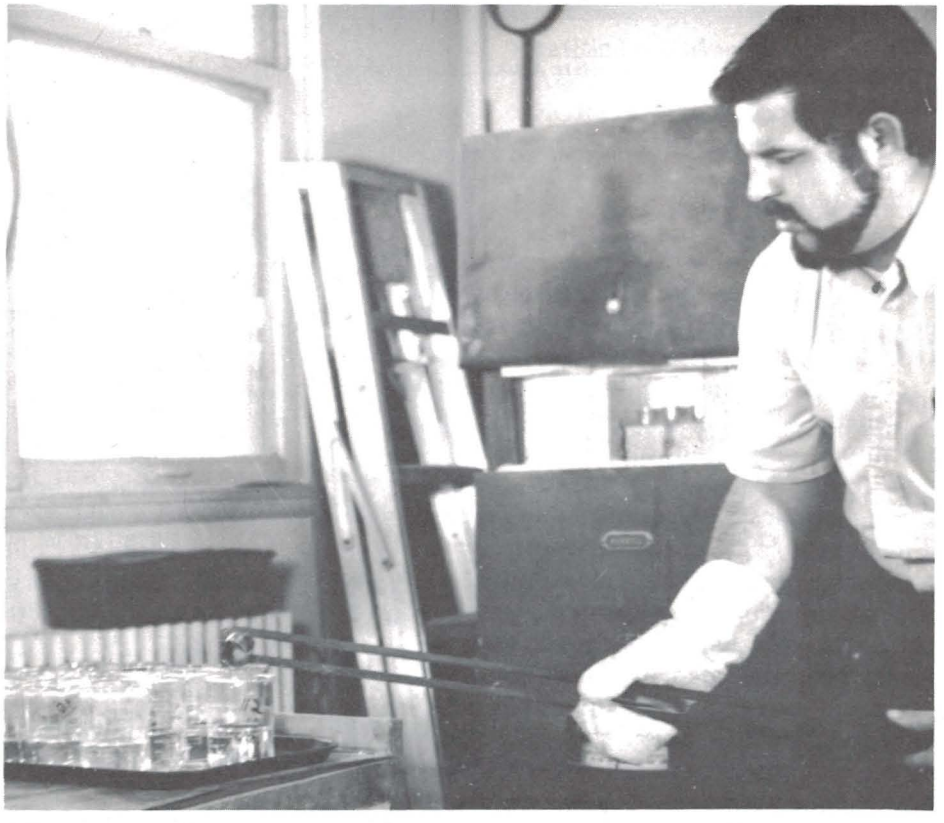
The following described projects are currently under study by the Laboratory.

Mineral Resources of Southeastern Alaska

Beginning with Northern Alaska in 1968, the Laboratory has undertaken to study the geology and mineral resources of different sections of Alaska. In 1969 a report entitled "Known and Potential Ore Reserves, Seward Peninsula, Alaska", was published, which described the occurrences and evaluated the potential for future production.

During the past year a similar study of Southeastern Alaska has been underway, and a report is being prepared. This report will list all of the deposits and prospects reported in the literature, with locations and brief data describing them.

Eleven plates, which have already been published and issued as MIRL Report No. 25, (see above) will show the geology of the region, and the distribution of all deposits, metallic deposits, and copper, gold, lead, molybdenum, iron and nickel deposits, as well as currently active claims and major faults.



Pouring fusions for beryllium analyses.

Digital pH meter for specific ion method for fluorine analyses.

There will be sections on the general geology of the region and of the several districts, as well as attempts to correlate ore deposits with geologic variables.

Copper Province Study

Simultaneously with the study of Southeastern Alaskan deposits, a similar one is being conducted for the copper deposits of the Copper River and Prince William Sound areas. This project is funded chiefly by the U.S. Bureau of Mines. In addition to searching the State Division of Mines and Geology Kardex files and the literature, early mining records will be examined to insure that no prospects are missed.

Coding of data is already complete, and the lists of mines and prospects are also completed. The geology of the region will be described, and a search made for possible ore controls.

Geochemical Analysis and Computer Processing

The Mineral Industry Research Laboratory analyzed the geochemical samples taken by the State Division of Mines and Geology during the 1969 field season. During the course of the work MIRL analyzed by emission spectroscopy 2773 samples for 30 elements each. The Laboratory also modified its computer processing program to produce tables for photo reproduction and inclusion in DMG reports. The mean, threshold value, anomalous value and standard deviation were calculated, and histograms for each element of interest were developed. A report describing the computer program is nearing publication.

Storage and Retrieval File for Southeastern Alaska Deposits

During the course of abstracting information for the Southeastern Alaska study, the data on the properties were digitized and stored on magnetic tape. MIRL Report No. 24, now almost ready for

publication, describes the storage and retrieval program that will make the information available to the using public. Sixteen options will be available, including some which will allow properties containing any of up to 12 elements to be selected for a particular area, and one that prepares a tape or set of cards for plotting or contouring.

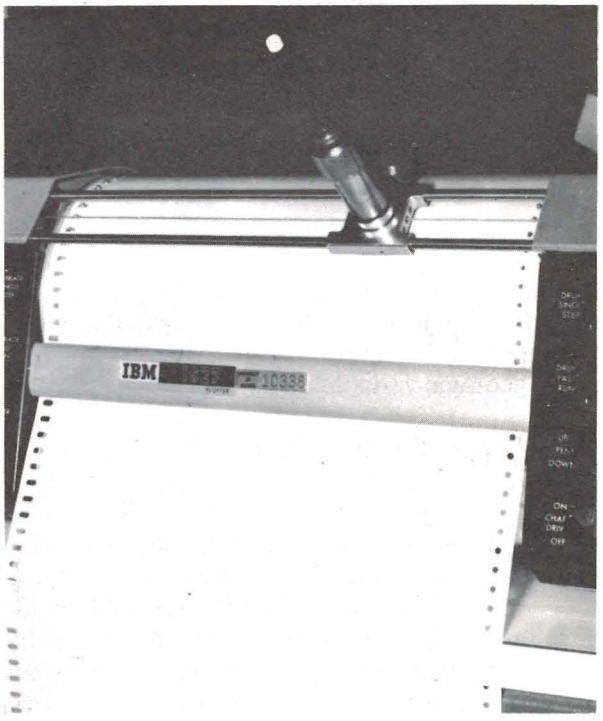
A mining company wanting information on particular minerals or properties in Southeastern Alaska may do so by contacting the Alaska Division of Mines and Geology. The Division in turn, will arrange with the computer center at the University of Alaska to retrieve the desired information at cost to the user. This function has been turned over to the Division because it is best able to perform the service.

Petrographic Determination of Rank of Alaskan Coals

The early determination of the petrographic rank of coals is very important in determining their possible value. Generally, however, coal collected from the surface has been weathered, and samples of such coal will not yield the true rank if subjected to standard analytical methods. Therefore, if petrographic rank could be correlated with some other property, it would be possible to determine the rank without obtaining fresh samples by costly drilling. The first such property tested has been reflectance. Samples from the Matanuska, Bering River, and Cape Beaufort fields were crushed to 20 mesh size, and separated by sink float at 1.6 specific gravity. The coal particles were embedded in an epoxy resin and polished sections were prepared. The reflectance of 50 vitamite grains was determined, using synthetic glass as standards. Evaluation of reflectance data against volatile matter showed that the low ASTM rank of Cape Beaufort coals was due to weathering, and that fresh samples would show high volatile rank. Additional studies will be made to correlate micro-indentation hardness with petrographic rank.

Gold Size Distribution

Flotation methods for recovering fine gold on sized fractions of samples were studied using samples of beach sands from Nome, Yakataga, and Bristol Bay, two river bar samples, and six placer samples from Hogatza. Only the Yakataga samples contained appreciable gold, and flotation proved very effective in recovery. Flotation could make a very good tool for preconcentration of gold from beach placers both during exploration and possibly for commercial operation. A report is being prepared for submission to the U. S. Geological Survey.



Making mineral commodity maps by computer driven plotter.

Analysis of Lost River Exploration Samples for Tin, Tungsten, Beryllium, and Fluorine

The Lost River deposit, known since early in the century, has always presented difficulties in that the elements contained are difficult to analyze. During the summer of 1970, the Laboratory analyzed several hundred samples from Lost River for tin, beryllium and fluorine. An entirely new method for tungsten was developed but as yet has not been used on the samples. Methods for the others were modified from known procedures. Tin and beryllium were analyzed by atomic absorption spectrophotometry and fluorine by the ion selective method. P. C. E. Exploration LTD. supported the work.

Reprinting Blazing Alaska's Trails

In 1953, the University of Alaska and the Arctic Institute of North America published "Blazing Alaska's Trails," from a manuscript left unfinished by Alfred Hulse Brooks, Alaska's greatest scientist-explorer. This unique book has long been out of print, and the Laboratory has undertaken the task of incorporating new materials, gathered largely by Dr. Terris Moore, second president of the University, into a second edition. This will be ready for publication during the next year.

FINANCES AND CONTRIBUTIONS

Funding for the Mineral Industry Research Laboratory for Fiscal 1969 is as follows:

Support provided by the 1969 State Legislature	$ 61,597.00
Contract with PCE Exploration for analytical research and core drill assay	$ 24,682.00
Contract with PCE Exploration for tin, tungsten beneficiation study	$ 4,748.00
Contract with State Division of Mines and Geology for spectrographic analyses and statistical analysis of stream sediments and rocks	$ 12,916.00
Contract with the U. S. Bureau of Mines for fine gold studies (with the Department of Mineral Engineering)	$ 31,091.00
Contract with the U. S. Bureau of Mines for a study of the copper occurrences, Wrangell Mountains-Prince William Sound area	$ 25,000.00
Reprinting NORTH Report, paid by the State of Alaska NORTH Commission	$ 7,259.00
TOTAL	$107,293.00

PUBLICATIONS

*ANNUAL REPORT OF RESEARCH PROGRESS by MIRL Staff, MIRL Report No. 1.

*THE MARKET POTENTIAL FOR ALASKAN CLAY PRODUCTS by Charles A. Beasley, MIRL Report No. 2, January 1965.

*ALASKAN CEMENT MARKETS AND OPPORTUNITIES FOR REGIONAL PRODUCTION, published as Research Monograph No. 4 by the Institute of Business, Economics and Government Research of the University of Alaska in cooperation with MIRL, February 1965.

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*MARKET FOR INSULATION IN ALASKA AND FEASIBILITY OF REGIONAL MANUFACTURE by Robert E. Haring and Charles A. Beasley, MIRL Report No. 4, 1965.

*ANNUAL REPORT OF RESEARCH PROGRESS 1965 by MIRL Staff, MIRL Report No. 5, January 1966.

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*NATURAL RESOURCE BASE OF THE FAIRBANKS NORTH STAR BOROUGH by Ernest N. Wolff and Robert C. Haring, MIRL Report No. 8, March 1967. With the Institute of Social, Economic and Government Research.

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TRACE ELEMENT COPPER DISTRIBUTION AND AREAL GEOLOGY IN A PORTION OF THE CLEARWATER MOUNTAINS, ALASKA by Paul S. Glavinovich, MIRL Report No. 10, May 1967.

*APPLICATIONS OF TREND SURFACE ANALYSIS AND GEOLOGIC MODEL BUILDING TO MINERALIZED DISTRICTS IN ALASKA by Lawrence E. Heiner and Ernest N. Wolff, MIRL Report No. 11, June 1967.

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*PRELIMINARY REPORT – MINERAL RESOURCES OF NORTHERN ALASKA by Ernest N. Wolff, Lawrence E. Heiner, and Frederick C. J. Lu, MIRL Report No. 13, November 1967.

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DISTRIBUTION OF CERTAIN MINOR ELEMENTS IN ALASKAN COALS by P. Dharma Rao, MIRL Report No. 15, June 1968.

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DEVELOPMENT OF A LIGHT-WEIGHT LOW COST SELF POTENTIAL UNIT by Kenneth L. Zonge, MIRL Report No. 17, June 1968.

KNOWN AND POTENTIAL ORE RESERVES, SEWARD PENINSULA, ALASKA by Frederick C. J. Lu, Lawrence E. Heiner, and DeVerle P. Harris, MIRL Report No. 18, September 1968.

HANDBOOK OF GEOPHYSICAL PROSPECTING METHODS FOR THE ALASKAN PROSPECTOR by Lawrence E. Heiner and Steven A. Wulf, MIRL Report No. 19, October 1968.

*HEAVY MINERALS IN ALASKAN BEACH SAND DEPOSITS by Donald J. Cook, MIRL Report No. 20, January 1969.

WASHABILITY CHARACTERISTICS OF LOW-VOLATILE BITUMINOUS COAL FROM BERING RIVER FIELD, ALASKA by P. Dharma Rao, MIRL Report No. 21, February 1969.

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***SOUTHEASTERN ALASKA MINERAL COMMODITY MAPS** by Lawrence E. Heiner and Ernest N. Wolff, MIRL Report No. 25, April 1970.

HANDBOOK FOR THE ALASKAN PROSPECTOR, Second Edition, by Ernest N. Wolff, August 1969.

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ALASKA MINING LAW MANUAL, Second Edition published, September 1970, by Charles F. Herbert.

*Out of Print.

MIRL SUPPORTED THESES

"The Feasibility of Utilization of Certain Alaska Bloating Shales for Lightweight Aggregate," M. S. Thesis, University of Alaska, Alvin Nelson Loskamp, May 1965.

"Coal Petrography as Related to the Preparation and Production of Coke from Selected Alaska Coals," M. S. Thesis, University of Alaska. Fred C. Hankinson, May 1965.

"Expansion Properties of Selected Elliot Highway Shales," M. S. Thesis, University of Alaska, Lawrence E. Heiner, May 1966.

"Trace Element Copper Distribution and Areal Geology in a Portion of the Clearwater Mountains, Alaska," M. S. Thesis, University of Alaska, Paul S. Glavinovich, May 1967.

"A Geographical and Geochemical Investigation of Mineralization on Hill 3560, Fortymile District, Alaska," M. S. Thesis, William Hovey Smith, December 1968.